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STATE OF ALASKA
Walter J. Hickel, Governor

ANNUAL REPORT OF PROGRESS, 1967 - 1968

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-9

SPORT FISH INVESTIGATIONS OF ALASKA

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INTRODUCTION

This report of progress consists of findings and work accomplished under the State of Alaska Federal Aid in Fish Restoration Project F-5-R-9, "Sport Fish Investigations of Alaska."

The project during this reporting period was composed of 21 separate studies. Of these, seven jobs continued the inventorying and cataloging of the numerous waters, providing a comprehensive index of the State's recreational waters. Nine jobs accomplished special studies involving Dolly Varden, grayling, silver salmon, king salmon and sheefish, among others. The remaining five jobs are designed to accomplish creel census, migration, access and silver salmon egg-take studies. The egg-take study, Job 7-F, was inactive because egg-takes were accomplished under other projects.

Special reports on specific phases of the Dolly Varden Life History Study have been published in the Department's Research Report series.

The information gathered from all of these studies provides the background necessary for better management and assists in development of future investigational studies.

The subject matter contained within these reports is often fragmentary in nature. The findings may not be conclusive and the interpretations contained therein are subject to re-evaluation as the work progresses.

RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.
Project No.: F-5-R-9 Title: Inventory and Cataloging of the Sport Fish and Sport Fish Waters in the Bristol Bay and Lower Kuskokwim Drainages.
Job No.: 12-A

Period Covered: May 20, 1967 to December 31, 1967.

ABSTRACT

An estimate of the escapement of king salmon, Oncorhynchus tshawytscha (Walbaum), in the Naknek River was obtained and was studied in relation to an estimate of that portion of the run utilized in the commercial, subsistence, and sport fisheries. It is concluded that a further increase in the utilization ratio will require more intensive management practices.

Length-age relationships of Naknek River rainbow trout, Salmo gairdneri (Richardson), sampled during 1967 were in agreement with those observed during the previous year; abundance of larger rainbow trout during late summer and fall months may have been reduced.

Information is presented on the timing, size, and age composition of the sport fishery for silver salmon, O. kisutch (Walbaum), in the Naknek River.

Angling success for rainbow trout in the Kulik River continued at a high level.

Information is presented on Gibraltar River and its rainbow trout population. A float survey of Belinda Creek is reported.

Late fall tagging and sampling at Lower Talarik Creek produced further evidence of the existence of fall spawning rainbow trout. Immature individuals ranging up to 54.5 centimeters in length were also present. Returns from the 1965 tagging at this location are presented. It was observed that migratory patterns of rainbow trout entering the sport fishery in Talarik Creek may vary widely with seasonal variations.

Hook and line sampling of grayling, Thymallus arcticus (Pallas), in the Ugashik watershed produced estimates of parameters for size and age of those fish available to the sport fishery. Comparison with samples from locations in interior Alaska confirms that Ugashik fish attain both greater length and age. The hypothesis is suggested that the populations which presently receive the bulk of fishing pressure may be composed of multiple, seasonally concentrated stocks. Notes are also presented on the occurrence and field identification of Dolly Varden char, Salvelinus malma (Walbaum), and Arctic char, S. alpinus (Linnaeus), in the Ugashik drainage. A successful transplant of red salmon, O. nerka (Walbaum), of Ugashik stock, to a barren moraine lake in the same watershed is described.

Hook and line sampling at the Tikchik Lake Narrows and in the Nuyakuk River, together with creel census work, defined the species and size composition of the sport catch at those locations during the late summer and fall of 1967. Notes are included on fish species at other sites in the lower Tikchik Lakes system.

RECOMMENDATIONS

1. In the Naknek River Watershed:
 - a. Attempt to determine the relationship between estimated and actual escapement of king salmon by operating a weir on King Salmon Creek and applying the observed ratio to the total survey index for the Naknek system. This should be done as soon as funds become available.
 - b. Continue and intensify observations of Naknek River rainbow trout, with special reference to spawning stock enumeration. Tagging should be conducted to define seasonal movement and the impact of the sport fishery on the annual spawning population.
 - c. Initiate surveys to locate spawning areas and obtain estimates of silver salmon escapement.
2. In the Algnak (Branch) River Watershed:
 - a. Continue to monitor the Kulik River rainbow trout fishery.
 - b. Survey the rainbow trout fisheries at the outlet of Kukaklek and Nonvianuk Lakes, Battle River, and Moraine Creek.
3. In the Kvichak River Watershed:
 - a. Conduct a program of observations, including tagging and population sampling, on rainbow trout at selected locations during spring, summer, and fall of the same year. Lower Talarik Creek and the Kvichak River in the Igiugig-Kaskanak Flats area are recommended as prospective sites for such studies.
4. In the Ugashik River Watershed:
 - a. Extend the grayling sampling program, supplemented by tagging, to additional locations throughout the system during both summer and fall to assist in determining the influence of seasonal movement upon the populations found at the Narrows and Outlet during the summer.
 - b. Continue incidental observations on Dolly Varden and Arctic char in conjunction with (a) above.
5. In the Nushagak River, Wood River Lakes, and Tikchik Lakes systems:
 - a. Continue and extend the population sampling of game fish species in the Tikchik Lakes area.
 - b. Initiate a program of investigation of the present status of rainbow trout populations in those waters of the Wood River system which currently support substantial sport fisheries.
 - c. Investigate the sport fishery potential of the Nushagak River king salmon run and extend the inventory of rainbow trout in the Nushagak-Mulchatna system.

OBJECTIVES

1. To determine the status of sport fish stocks within the job area with emphasis on rainbow trout in the Naknek River drainage.
2. To assess and record the environmental characteristics of the existing and potential recreational fishing waters of the job area with emphasis on the Naknek River drainage.
3. To enumerate king salmon spawning stocks in the Naknek River, its tributaries, and in the Alagnak (Branch) River.

4. To determine the impact of other anadromous and freshwater fishery uses in relation to existing recreational anadromous and resident fish stocks.
5. To investigate multiple water use projects (both public and private) and to assess their effects upon the watersheds of the area.
6. To determine the need for and implementation of fishery restoration measures, including location of suitable sport fish egg sources.
7. To assist, as necessary, in the investigation of public access status of the sport fishing waters of the job area and to make recommendations for specific public access sites.
8. To provide recommendations for the management of sport fishing resources in these waters and direct the course of future studies.

TECHNIQUES USED

Species composition and distribution was determined by use of seine, gill nets, and hook and line.

King salmon escapement in the Naknek River system was estimated by aerial and float surveys. King Salmon Creek and Big Creek were surveyed by H-21 helicopter and the Naknek River was surveyed by use of a Piper Super Cub. Aerial surveys of Lower Talarik Creek were also made with a Super Cub.

Personnel of the Commercial Fisheries Division at several field stations assisted by reporting data from their personal sport catches. Some samples were also contributed by responsible individuals who had been instructed in collecting methods.

Length measurements were recorded in inches in the field and later transposed to metric equivalents. Fork length is used exclusively.

Age determinations were first made using a binocular microscope after scales had been impressed into 0.02-inch-thick cellulose acetate. Problems in determining age of larger grayling were resolved to a large degree by direct examination of the scale.

Pedersen disc tags were used in the 1967 Talarik Creek tagging. Numbered tags were bright red, while opposing tags were white. Tag diameter was 5/8-inch. Tags were applied without use of anaesthetic.

FINDINGS

Naknek River King Salmon Studies

The sport catch of king salmon in the Naknek River during 1967 was estimated to be approximately 1,579 fish.

The total take of king salmon for subsistence purposes from the Naknek River during 1967 is estimated by the Division of Commercial Fisheries at 699 fish.^{1/} This estimate is based on an extrapolation of reports received from responding permittees in relation to the total number of permits issued.

Redick (1967) discussed the commercial fishery of the Naknek-Kvichak District in some detail as it relates to the return of king salmon in the Naknek River. The commercial catch for the entire district during 1967 is listed as 3,705 fish.^{1/} This figure includes king salmon bound for the Alagnak (Branch) and Kvichak Rivers.

^{1/} Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay area Annual Management Report, 1967. 65 p. Unpublished manuscript.

Surveys of king salmon escapement in the Naknek River were first undertaken in 1963. Comparative counts for the year 1963-1967 are available for Big Creek, tributary of the Naknek River (Table 1). Big Creek is one of the three major spawning grounds of the Naknek River run. Its escapement appears to have been relatively constant during this period, with the exception of the unusually large return of 1963 and a possibly reduced return in 1965. During the 1967 surveys, it was again noted that the peak of spawning apparently occurs earlier in the lower portion of Big Creek than in the upstream portion. During the period of the float survey of Big Creek (August 10-14) many unoccupied redds were noted in the lower portion while kings were generally present on the gravels of the upper area.

TABLE 1. King Salmon Escapement Survey Summary, Big Creek, Tributary of Naknek River, 1963 - 1967.

<u>Year</u>	<u>Type of Survey</u>	<u>Count</u>	<u>Adjusted Estimate</u>	<u>Remarks</u>
1963	Aerial	1,345	2,690	Float surveys of Big Creek have been relative to concurrent aerial counts by a factor of 2 or greater; hence the doubling of the aerial count to obtain an adjusted estimate.
1964	Float	1,130	1,160	Float begun shortly below head of spawning. Adjusted by adding 1967 count for area not included this year.
1965	Float	578	867	Survey commenced at point presently estimated to be two-thirds of distance from mouth to headwaters. Adjusted by addition of one-half of survey count.
1966	Float	971	1,223	Survey commenced below start of spawning. Adjusted by addition of 1967 count for area not included this year.
1967	Float	1,129	--	Survey commenced at head of spawning.

Both aerial and float surveys of King Salmon Creek were largely unsuccessful during 1967 due to poor visibility caused by high, turbid water conditions which prevailed during the peak of spawning. Although a total of only 281 fish was sighted during the float survey of the entire stream, it is felt that the low count resulted from the reduced visibility. The escapement level was probably comparable with that observed in other years, or approximately 600-750 fish.

An aerial reconnaissance of the main Naknek River during mid-August produced an estimate of 800 spawning king salmon, most of which concentrated in the area immediately below the first rapids and in the area below the point of the "Big Bend" just downstream from the Rapids Camp. This marks the first attempt to enumerate this segment of the spawning population. The timing of movement onto the spawning gravels and peak of spawning activity have not been determined for this segment of the Naknek run.

Some spawning also apparently takes place in that portion of the Naknek River immediately above and below the King Salmon Creek confluence, but satisfactory aerial surveys are difficult due to water turbidity.

No attempt was made to enumerate spawners in the Alagnak River system during 1967.

Summary of King Data:

Current estimates of subsistence and sport catches are not yet precise. The actual extent to which the Naknek-Kvichak District commercial fishery may bear upon the Naknek River run of this species remains unknown. Escapement counts are basically intended to provide an index and are minimal. From Table 2 it is possible to reasonably conclude that utilization of this run, at the abundance level of the 1967 return, is fast approaching the point where immediate surveillance of all three participating fisheries will be a mandatory management requirement.

TABLE 2. Catch and Escapement Estimates for Naknek River King Salmon, 1967.

<u>Segment of Run</u>		<u>Number of Fish</u>
Catch		
Commercial	* & **	1,853
Subsistence	**	699
Sport		1,579
Total Catch		4,131
Escapement		
Big Creek		1,129
King Salmon Creek		600
Naknek River		800
Total Escapement		2,529
Total Return		6,660
* One-half of Naknek-Kvichak District commercial catch of 3,705 fish arbitrarily assigned to Naknek River run for purposes of this discussion.		
** From A.D.F. & G., Division of Commercial Fish, Bristol Bay Area Annual Management Report, 1967. 65 p. unpublished manuscript.		

Naknek River Rainbow Trout

Field work was commenced too late in the season due to the vacancy of the investigator's position to add further information on the 1967 spawning population of rainbow trout. Catch sampling procedures during the remainder of the season yielded additional data on length ranges for fish of given age groups, though adequate numbers for statistical treatment were available only in the younger classes represented in the fishery. Age-length comparisons between the 1966 samples (Redick, 1967) and those collected in 1967 were in agreement except for higher, upper range extensions and higher mean lengths for the younger age classes. This is to be expected due to the later sampling dates.

Availability of larger (500 centimeters in length or greater) rainbow trout after the cessation of the smolt outmigration of red salmon during mid-July was notably poor.

Naknek River Silver Salmon

Observation of the sport fishery for silver salmon in the Naknek River covered its entire length during the 1967 season. Catch sampling indicated a length range of from 56.4 to 72.3 centimeters, with a mean length of 65.0 centimeters. Males outnumbered females in the sport harvest by a ratio of approximately 2:1. The entire sample had spent two winters in fresh water and one winter in the ocean prior to return.

Scattered fish first appeared off the mouth of King Salmon Creek during the last week of July, with good numbers being present during the entire month of August. While still present until at least mid-September, movement into the tributary spawning areas evidently takes place sporadically, with the result that fishing success during September is inclined to be highly variable.

No attempt at locating spawning areas and determining dates of peak spawning activity has yet been attempted, though spawning silvers have been reported from King Salmon Creek, Big Creek, and Brooks River.

Alagnak (Branch) River Rainbow Trout

During this report segment, no sampling was conducted in this watershed other than at the Northern Consolidated Airline's Angler's Paradise Camp at Kulik River. The fishery here has shown little change since described by Andrews (1961). The rainbow trout population of the Kulik River gives every evidence of excellent health, as witnessed by an unusually high rate of fishing success during the 1967 season. This is attested to by both the statements of the camp management and the results of hook and line sampling by Division personnel. Catch per unit of effort during this sampling, which was carried out during the period August 5-9, was 8.95 fish per hour. Sixty-four samples from the sport catch gave a mean length of 37.8 centimeters, with a range from 20.3 to 53.3 centimeters. By contrast, a similar sample taken during August, 1964, averaged only 25.7 centimeters, with a range of 24.6 to 63.4 centimeters in length (Paddock, 1965). Ages of the 1967 sample ranged from two to seven years and scales failed to exhibit the increased growth rate associated with lake rearing which was present in a portion of the 1964 sample.

Kvichak Watershed Studies

Gibraltar River:

This stream, flowing over a 4 1/2-mile course between the outlet of Gibraltar Lake and its confluence with Lake Iliamna was sampled throughout its length with hook and line during the last week of June, 1967. Most fishing effort is exerted at the outlet of Gibraltar Lake. Excellent success was also enjoyed in the lower portion, though a two-mile section of swift water commencing one-half-mile below the outlet precludes satisfactory effort in that portion. Rainbow trout were encountered wherever stream conditions permitted sampling and small (under 13.0 centimeters in length) Dolly Varden char were taken at the confluence with Lake Iliamna.

A sample of 27 rainbow trout ranged from 29.2 to 48.4 centimeters in length, with a mean of 43.1 centimeters. The entire sample was composed of fish displaying the dark colored, highly spotted characteristics of a "stream-type" population as opposed to the bright, silvery appearance of individuals which have recently been residing in the waters of Lake Iliamna (Paddock, 1965). Ages ranged from three to seven years. None of the scales collected at this date exhibited the accelerated "lake-type" growth commonly encountered in large trout taken from Iliamna Lake tributaries. Large lake-run fish are reportedly taken here later in the year.

Belinda Creek:

Belinda Creek furnishes the major recreational outlet for personnel manning the White Alice site at Big Mountain and is readily reached by road from the Big Mountain airport. It currently supports an intensive fishery from break-up to freeze-up. Rainbow trout, Dolly Varden char, and red salmon are the principal species taken in the sport catch. The first visit of Sport Fish Division personnel to the area since Statehood was made during the last week of June, 1967, when nearly the entire length of the stream was traversed by rubber raft.

Originating in the tundra, south of Big Mountain on the south shore of Lake Iliamna, Belinda Creek meanders first through a broad valley bordered by open rolling hills. Approximately eight miles from its mouth it enters a

narrow canyon, where its gradient increases sharply and the bed of the stream is strewn with large boulders. The banks of this section are thickly lined with cottonwood and heavy vegetation to within a half-mile of its confluence with Lake Iliamna, although the stream emerges from the canyon some two miles from the lake. Average stream width is about 35 feet and normal summer flow is estimated to be 70 cfs. The entire stream is available to salmon, with escapements of 3,000 red salmon reported routinely (Demory, et. al., 1964).

During the 1967 survey, only grayling and juvenile rainbow trout (age I and II) were observed above the mouth of the stream. Red salmon were congregated thickly at the mouth itself where they were the object of a snag fishery. Site personnel reported that rainbow trout are available during the spring and fall.

At the time of the construction of the White Alice site about 12 years ago, Belinda Creek provided the construction crews with an excellent fishery for trophy rainbow trout. No measure of the present status of this stock or of the success enjoyed by the rainbow fishery is now available, but a drastic decline is reported by unofficial observers.

Lower Talarik Creek:

One visit was made to this area during the report segment, but the mid-November date of this visit extends prior Division observations approximately 30 days later in the year. Paddock (1965) reported observing an estimated 400 rainbow trout spread out in spawning array throughout the East Fork, in the headwater lakes of the West Fork, and in the lagoon above the outlet during mid-October, 1964. At the time of the 1967 visit, no paired spawners were seen in the East Fork, although a limited number of fish thought to be rainbow trout were noted on the spring-fed gravels of the first West Fork lake. Mature specimens were sampled at both the inlet and outlet of the Lower River Lagoon. Some of these were ripe while others evidenced recent cessation of spawning activities. Bright silver, immature fish were also taken by hook and line at the lagoon. A comparison of these two groups is presented in Table 3.

TABLE 3. Sampling Data for Rainbow Trout, Lower Talarik Creek, Kvichak River Watershed, November 13-16, 1967.

No. In Sample	Sexual Maturity	Appearance	Length Range (cm)	Mean Length (cm)	Age Range (years)
22	Immature	Silvery; bright	33.7 - 54.5	49.5	4 - 7
7	Ripe	Rainbow stripe dark; many black spots below lateral line.	51.4 - 69.8	62.1	5 - 9

Recovery data from the 1964 tagging work in Lower Talarik Creek was reviewed by Paddock (1965). Returns since that time consist of four recoveries from a total of 17 fish tagged during 1965. Fifteen rainbow trout were tagged and released during the 1967 visit.

Three tag returns have been received from fish tagged in the first West Fork lake on July 4, 1965. An age III rainbow which measured 41.9 centimeters at tagging was reported to weigh approximately 6 pounds (estimated 63.5 to 66.0 centimeters in length) when recovered in the lower reaches of the stream on September 16 of the following year. The fish was released again by the angler. This reported growth increment is in general agreement with growth increases observed in age analysis of fish displaying the accelerated growth attributed to rearing in the lake environment following the initial period of stream residence (Paddock, 1965).

Two other rainbow tagged at this location on the same date were recovered in the same immediate area; the first in September, 1966, and the second during July, 1967. Neither fish was measured precisely upon recovery but estimated lengths agreed closely with length at time of tagging. Age at tagging of the first fish could not be determined due to the regenerated condition of the scale sample. The second fish was age VI at tagging, with a fork length of 47.0 centimeters, and displayed no accelerated growth.

A third rainbow recovery was a bright, age V fish, 66.0 centimeters in length, tagged at the mouth of Talarik Creek on May 26, 1967. This fish exhibited three seasons of "lake type" growth in its scale growth characteristics. Released into Lake Iliamna, it was recovered 25 days later in a subsistence net at Iliamna village, approximately 28 miles away.

These recoveries, together with those reported earlier, indicate an intermingling in the fishery of rainbow trout displaying varied behavioral patterns. It seems that some fish taken at or near the outlet do not intend to spawn in this stream or remain there for any extended period, while others have obviously migrated to Lake Iliamna to return after a time. Still others, apparently residents of the small headwater lakes, may never leave the Lower Talarik Creek watershed.

Ugashik Lakes Grayling Studies

Grayling data from the Ugashik watershed were obtained by Sport Fish Division personnel and through the cooperation of the Commercial Fisheries Division crew stationed at the outlet of Lower Ugashik Lake. A measure of the typical sport fish bag was obtained by sampling with hook and line. With minor exception, all samples were collected at the connecting river between the Upper and Lower Ugashik Lakes (referred to as the Narrows) and at the head of the Ugashik River at the outlet of Lower Ugashik Lake (referred to as the Outlet). The collected data permits estimates of the size composition of the sport catch and the age-length relationship for these classes represented.

Andrews (1966) previously noted the occurrence of large grayling in the sport fishery from this system. Another unusual feature is the virtual absence of smaller, younger age classes. Seventy-eight percent of the sample exceeded 39.9 centimeters in length. Mean length was 45.0 centimeters with the mode close by in the 45.0 - 47.5 grouping. Less than five percent of the sample were below 37.6 centimeters in length and no grayling shorter than 30.4 centimeters were encountered during the sampling effort (Figure 1).

Age ranged from three to nine years, as indicated by annulus counts (Figure 2). A comparison of this stock with those of interior Alaska reveals that Ugashik fish evidently attain a greater age and also enter the fishery later. Reed (1964), reporting on collections from the Tanana River drainage, found no fish older than age VIII, with the modes of the oldest populations at age VI. The largest specimen in his sample of 1,300 grayling did not exceed 47.5 centimeters in length. The age mode of the 1967 Ugashik sample falls at age VII, with a mean length of 47.1 centimeters (Table 4). It should be noted that the overall collection for this year includes sub-samples obtained from June to October, thus covering much of the growing season.

Statistical analysis of the distribution in the higher age groupings indicates the probability that some age IX fish may be included in the age VIII group due to misinterpretation. It is also possible that some age VIII fish may be included in the age VII group. This emphasizes the problems encountered in accurately interpreting the age of older specimens. Difficult scale impressions were frequently abandoned to read directly from the scale itself. This method may prove most satisfactory for all future determination of older specimens.

Sampling at the Narrows and Outlet late in the fall (mid-October) revealed a marked decline in availability from that observed during the June-September period. Grayling were no longer present in the shallow areas in the concentrations noted earlier. Some individuals remained, though these displayed a preference for the deeper reaches of these waters. At this same time, schools of large fish were found in the deep pools of the lower portions

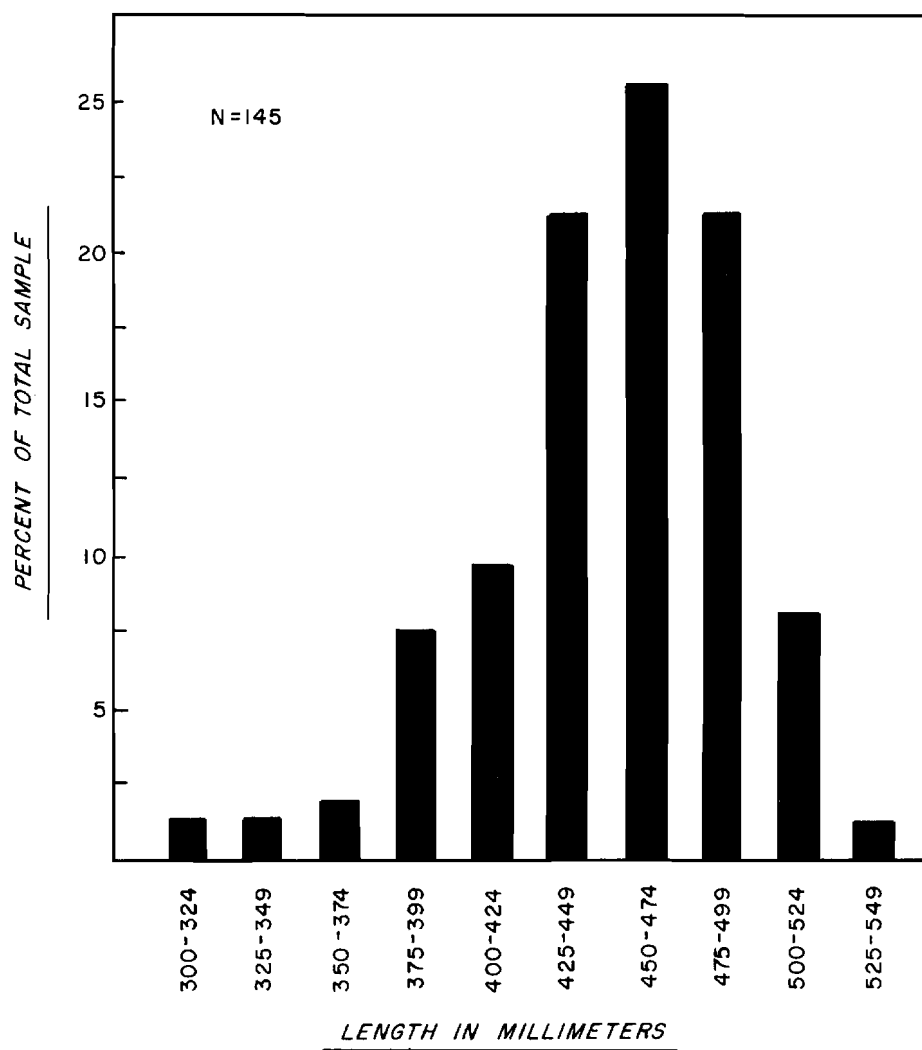


FIGURE 1. LENGTH FREQUENCY, UGASHIK GRAYLING 1967.

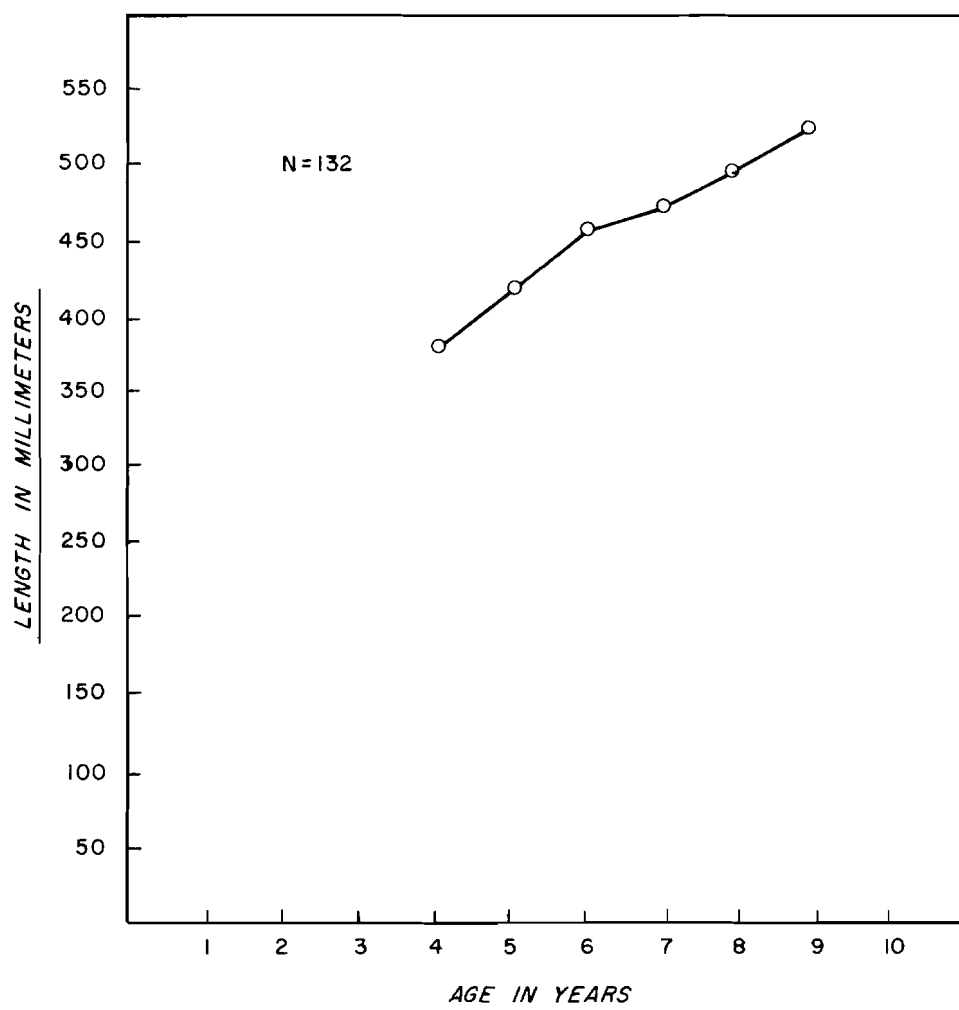


FIGURE 2. LENGTH-AGE RELATIONSHIP, UGASHIK GRAYLING, 1967.

of tributary streams. The strength of concentration in these latter areas prior to this date is not yet known, but it may be postulated that the fish which support the seasonal fishery at the Narrows and Outlet may migrate from a number of other areas throughout the system, and disperse once again in the fall. The reason for this seasonal movement is not known, but it may well prove to be associated with the availability of food at the lake outlets during summer and early fall months.

It is evident that the Ugashik grayling presently offer a highly desirable sport fishery due to their unusually large size. If the populations at the Narrows and the Outlet are made up of stocks from a number of contributing areas within the system, they may reflect the effects of significant exploitation very quickly.

Ugashik Lake Char Studies

Both Dolly Varden char and Arctic char are taken frequently along with grayling in the Ugashik sport fishery, particularly at the Narrows. Species differentiation may be difficult for some specimens from external characteristics alone until a careful examination has highlighted distinguishing features. Original determination is best accomplished by counts of the pyloric caeca, as counts of rakers on the lower limb of the first gill arch shows a high degree of overlapping. While examinations have not been extensive, the mode of caecum counts on Dolly Varden can be expected to be approximately 30, and that for Arctic char approximately 45. These modes agree with those cited by Bond and Becker (1963) for the Kvichak watershed.

After definite identification has been made, it will become apparent that the size of the spots on the sides of S. alpinus is larger and their coloration less intense than for those on S. malma. Also, vermiculations on the backs of S. alpinus are more pronounced. Dolly Varden coloration tends toward dark green upon the back, while Arctic char are usually of a brownish hue. However, some younger specimens also exhibit the green coloration typical of S. malma and this feature cannot be relied upon for differentiation.

All mature Dolly Varden taken at the Narrows in mid-October had recently finished spawning. Sampling of Arctic char from the same area during 1967 was less conclusive than for Dolly Varden in respect to timing of spawning activity, and further observations are in order. Concurrent spawning of such closely related species in the confined proximity of the Narrows may contribute to the apparent intergradation of many characteristics.

Arctic char in excess of 10 pounds in weight and 76.2 centimeters in length are not uncommon in the Ugashik sport fishery, but the mean length for an 18 fish sample taken by angling during October, 1967, was 55.1 centimeters and ranged between 40.6 and 66.0 centimeters. Seventeen Dolly Varden taken at this same time averaged 54.1 centimeters and ranged between 39.3 and 63.4 centimeters in length.

Lake trout, S. namaycush (Walbaum), are readily available to angling in Lower Ugashik Lake off the mouth of the Narrows and are also frequently taken at the Outlet early in the summer. Length of a nine-fish sample taken with hook and line ranged between 40.5 and 63.6 centimeters with a mean of 53.6 centimeters.

Stocking of Barren Lake in Ugashik Area

During 1965, Sport Fish Division personnel planted red salmon smolts in an unnamed lake, known locally as Airplane Lake, located approximately 0.8 miles from the village of Pilot Point. During August, 1967, a 125-foot variable mesh sampling net was fished in the lake to monitor the success of the plant.

Airplane Lake is an 80-acre moraine lake typical of many such lakes in the Bristol Bay area. Its elevation is approximately 65 feet. Maximum depth is thought to be near 20 feet, with an estimated mean depth of 12 to 15 feet. Beaches and much of the bottom are composed of pea- to egg-sized gravel and aquatic organisms are abundant. No fish life was present prior to the plant

other than three-spine stickleback, Gasterosteus aculeatus (Linnaeus), and probably Alaska blackfish, Dallia pectoralis (Bean). No attempt was made to eradicate these prior to planting.

The 1965 plant was taken from the Ugashik River smolt outmigration on June 1 of that year and was obtained through the cooperation of the Commercial Fisheries Division. The fish were secured during the regular sampling program of that division and held in live boxes until transferred to milk cans a few hours later for the plane trip to the lake. No anesthetic was used during the transfer. The fish were released directly into Airplane Lake from the twin-engined amphibian used in transporting them from the Lower Ugashik Lake outlet. Effective size of the plant was estimated to be approximately 800 fish.

Based on data from the outmigration study (Nelson, 1966), 84 percent of the fish planted in Airplane Lake were age II, while the remaining 16 percent were age I. Mean length of age I smolts was 93.8 millimeters, with a mean weight of 6.7 grams. Mean length of age II fish was 114.1 millimeters, with a mean weight of 12.3 grams.

The 15 kokanee sampled August 25-27, 1967, ranged from 24.9 to 37.0 centimeters in length, with a mean of 29.2 centimeters. Comparing the 1967 mean length with the weighted mean length at date of planting shows a mean annual growth increment of 60.7 millimeters in length and a mean annual weight increment of 55.4 grams for each of the three growing seasons.

Of the 1967 sample, 73 percent (N=11) were males and 27 percent (N=4) were females. All of the males were mature and ripe, while only one of the females was mature. The ovaries of the mature female contained approximately 400 eggs. It is not known, however, whether the new environment will be conducive to natural reproduction.

Stomach analysis of sampled specimens showed that three-spine stickleback constitute a major food source for the salmon at this stage. Also in evidence were leeches and caddis fly larvae.

Growth and survival of this plant can be considered satisfactory, demonstrating the feasibility of developing acceptable sport fish stocks in similar situations at a minimum of cost and effort.

Tikchik Lakes - Nuyakuk River Area

During a two-month period from mid-August to mid-October, sampling work was carried on in the Tikchik Lake area at the Narrows between Nuyakuk and Tikchik Lakes. Additional data collected during this period is presented in D-J Job 12-D of this report segment. Yanagawa (1967) also recently discussed the fish populations and ecology of the system.

Grayling:

Sampling at the Tikchik Lake Narrows and in the Nuyakuk River with hook and line showed grayling to be readily available to sport gear. Catch success of 2.18 grayling per hour at the latter location compares favorably with the 1.58 fish per hour figure observed at the Narrows. Mean length for both samples was 32.7 centimeters, which coincides closely with the age IV groupings (Figure 3). Further examination of the length composition of the two samples shows a marked difference in location of the mode (Figure 4), which is also reflected in the age structure of the samples (Figure 5). The diversity in size make-up of the population is significant for ages III and V of the sample and is indicative of an effective physical separation of the two populations. Such differences may be the result of varying degrees of survival success between the two areas for the age classes concerned. It will also be noted that, in marked contrast with the Ugashik grayling fishery, individuals of all age classes enter the sport take here.

The largest grayling encountered during the investigation in the Tikchik Lakes area were found at the mouth of the Allen River where it empties into Lake Chauekuktuli. Mean length of the limited sample taken here was 45.5 centimeters, which is 12.8 centimeters greater than the mean of the Tikchik

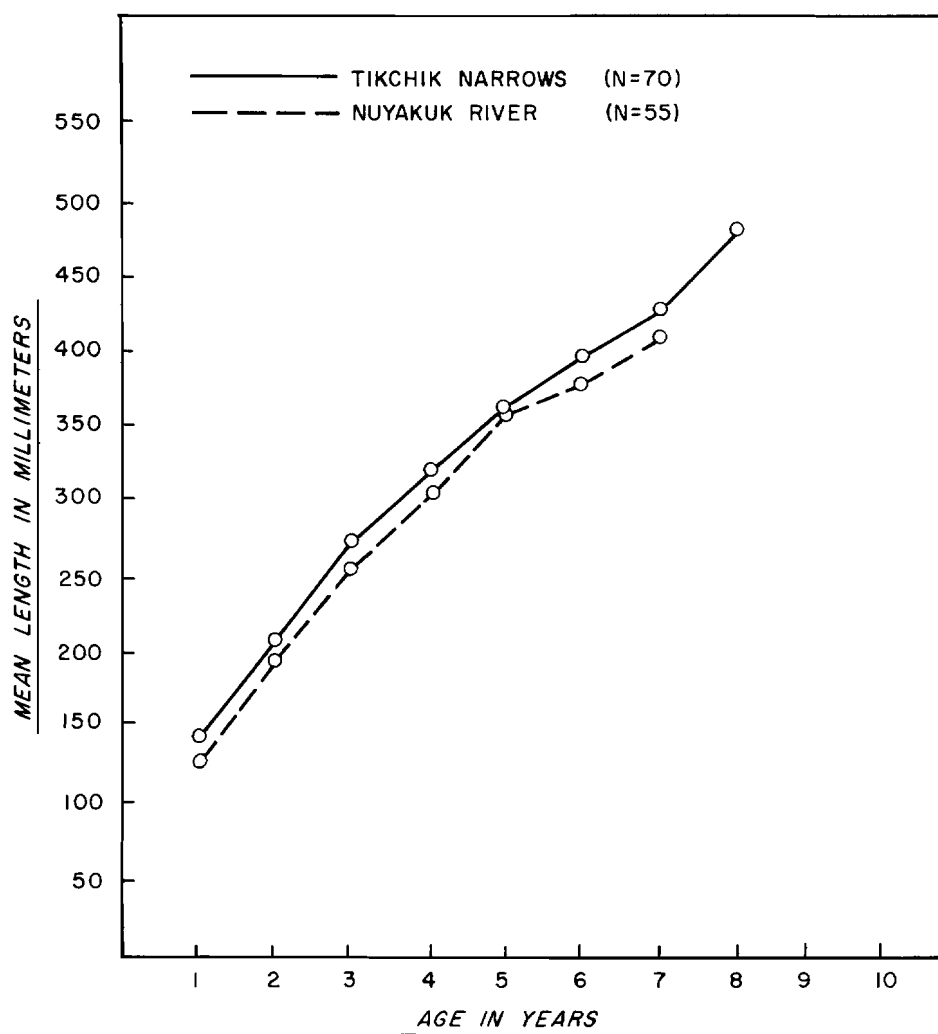


FIGURE 3. LENGTH-AGE RELATIONSHIP TIKCHIK NARROWS AND NUYAKUK RIVER GRAYLING, 1967.

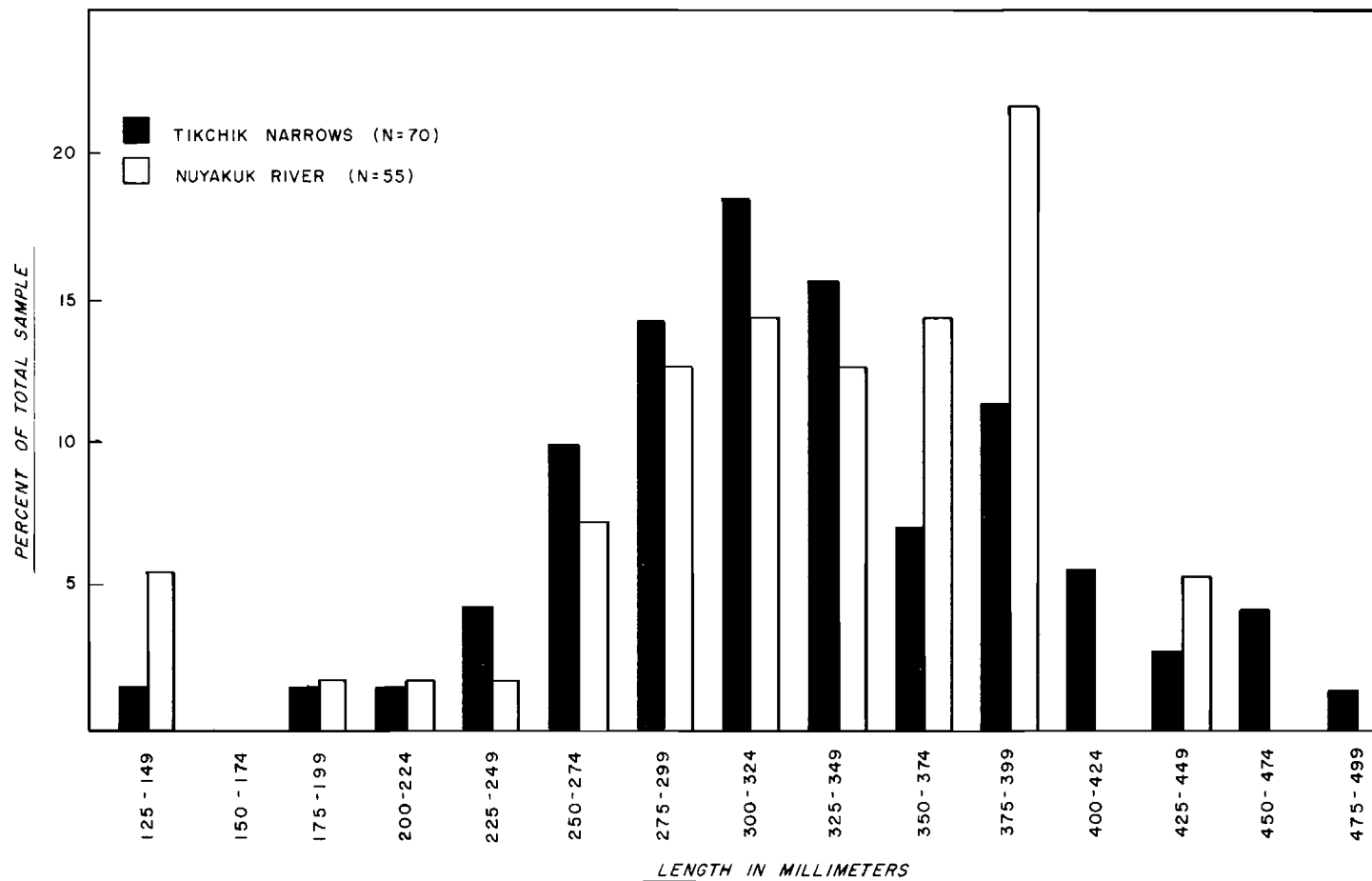


FIGURE 4. COMPARISON OF LENGTH FREQUENCY RELATIONSHIPS OF GRAYLING SAMPLES FROM TIKCHIK NARROWS AND NUYAKUK RIVER, 1967.

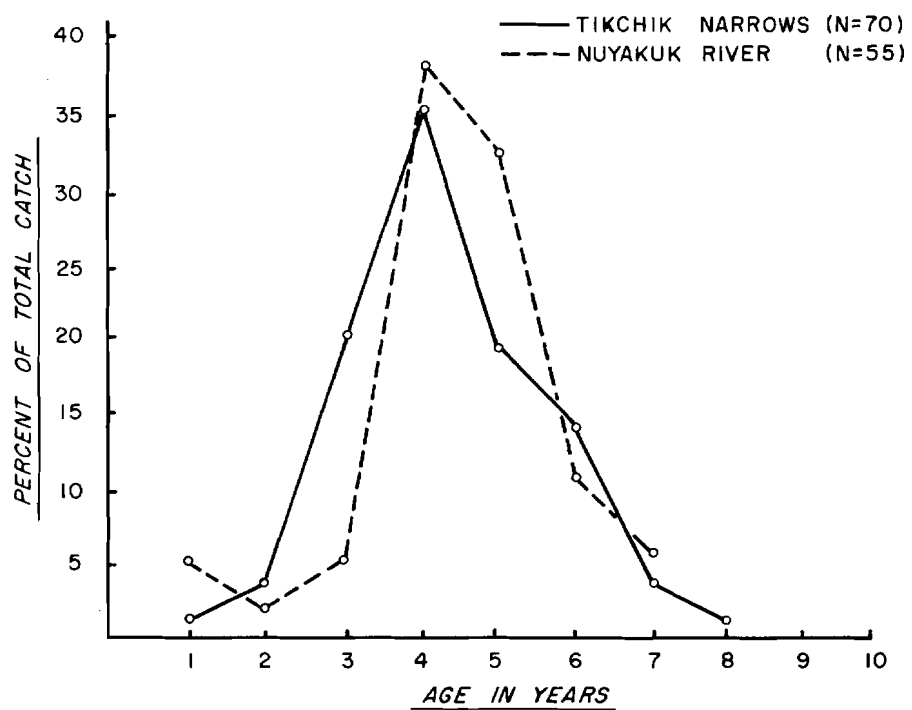


FIGURE 5. GRAYLING CATCH COMPOSITION BY AGE, TIKCHIK NARROWS AND NUYAKUK RIVER, 1967.

TABLE 4. Length Frequency of Rainbow Trout, Tikchik Lake Narrows and Nuyakuk River, 1967.

Water	Number of Fish (in Four-Centimeter Size Groups)													N
	28	32	36	40	44	48	52	56	60	64	68	72	76	
Nuyakuk River*	2	1	2	2	-	4	2	2	4	1	1			21
Mean Length	29.9	35.6	36.6	40.4		49.9	54.6	59.1	62.1	64.3	71.9			50.6
Tikchik Lake Narrows					1					2	2		1	6
Mean Length					45.7					67.3	70.6		76.2	66.3
* Includes Tikchik Lake Outlet														

TABLE 5. Length Frequency of Lake Trout and Arctic Char, Tikchik Lake Narrows, 1967.

Fish	Number of Fish (in Four-Centimeter Size Groups)													N
	28	32	36	40	44	48	52	56	60	64	68	72	76	
Lake Trout		1	2	8	13	27	39	18	10	3	2	1	3	127
Mean Length		35.6	38.1	42.2	45.8	59.6	54.0	58.3	61.9	66.5	70.6	72.5	76.6	53.4
Percent of Sample		0.1	1.7	6.4	10.6	21.3	30.8	14.3	8.0	2.5	1.7	0.1	2.5	100.0
Arctic Char	1	1		1		1	6	4	2					16
Mean Length	28.0	35.6		43.2		48.2	53.6	57.8	61.7					51.9

Narrows or Nuyakuk River grayling. Range of the sample was from 41.3 to 48.3 centimeters.

The mile-long unnamed river connecting Nayukuk and Chauekuktuli Lakes was sampled at the upper inlet and lower outlet ends. In spite of the limited sample size (N=14), it was apparent that the grayling were segregated according to size within the river. The sample at the Chauekuktuli outlet ranged between 40.7 and 48.3 centimeters, with a mean of 45.3 centimeters. The sample taken at the Lake Nuyakuk end of the stream had a 27.5 centimeter mean, with a range between 22.9 and 35.6 centimeters. The factors responsible for this phenomenon can not yet fully be explained.

Rainbow Trout:

Rainbow trout were found to be confined largely to the Nuyakuk River. A few were taken by casting and trolling at or near the Tikchik Narrows. None of these rainbow were less than 45.7 centimeters in length (Table 4). This species is rarely reported west of the Narrows. These facts suggest that the Tikchik Lakes themselves may not host reproducing populations of rainbows. Individuals found above the outlet of the system may have entered from the Nuyakuk River after having reached a certain size threshold. More comprehensive sampling is needed.

Northern Pike:

Pike Slough, draining into the extreme northeastern end of Lake Nuyakuk, appears to be ideally suited to the northern pike, Esox lucius (Linnaeus). No other sport species was taken at this location. The largest pike sampled was 104.0 centimeters in length and weighed 17 pounds. Other pike producing areas occur throughout the entire lake system but these await sampling by Division personnel.

Lake Trout and Arctic Char:

Lake trout and Arctic char occur throughout the entire lake system. Lake trout are more readily available to sport gear. Size composition of the 1967 sample is shown in Table 5. The Narrows, between Tikchik and Nuyakuk Lakes, has provided the best success to date for both species. Fishing from shore is usually productive here, and also works well at other locations, particularly during late fall. Trolling or casting from a boat in deeper water usually assures best results.

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